

The importance of the spatial configuration of marram grass (*Calamagrostis arenaria*) on dune functioning and biodiversity

Ruben Van De Walle^{1,2}, Jasmijn Hillaert³, Martijn L. Vandegehuchte⁴, François Massol² and Dries Bonte¹

¹ Terrestrial Ecology Unit (TEREC), Department of Biology, Ghent University, K.L. Ledeganckstraat 35, 9000 Ghent, Belgium

E-mail: ruben.vandewalle@ugent.be, dries.bonte@ugent.be

² Université de Lille, CNRS, Inserm, CHU Lille, Institut Pasteur de Lille, U1019 - UMR 9017 - CIIL - Center for Infection and Immunity of Lille, 59000 Lille, France

E-mail: francois.massol@univ-lille.fr

³ Research Institute for Nature and Forest, Brussels, Belgium

E-mail: jasmijn.hillaert@inbo.be

⁴ Norwegian University of Science and Technology, Department of Biology, Høgskoleringen 5, 7491 Trondheim, Norway

E-mail: martijn.l.vandegehuchte@ntnu.no

Dunes are beneficial to humans because they provide ample ecosystem functions such as recreation and flood protection (Van der Biest *et al.* 2017). Marram grass (*Calamagrostis arenaria*) is the keystone-species in dune development because of its effective sand fixation. This enables dunes to grow, counteracting sea-level rise due to climate change, and furthermore regenerate e.g. after a storm. The spatial configuration of marram grass influences its sand fixation capabilities (Reijers *et al.* 2019) and thus also the self-regenerating capabilities of the dune as a whole. Dunes formed by this keystone species are important to biodiversity and are additionally protected by the habitat directive (Bonte *et al.* 2021). Whether the spatial distribution of this grass impact dune development and its functioning, and whether it aligns with optimal biodiversity targets is unknown.

We quantified how (the strength of) the relation between the spatial configuration of marram grass is correlated to its self-regenerating capabilities by modelling, and tested whether biodiversity patterns followed the same direction. Our model includes feedbacks between vegetation development and dune growth and is therefore one of the first that allows testing the joint impact of multiple boundary conditions on the dynamics of dune and vegetation growth. We present the first results from this model analyses. We additionally investigated the link between the spatial configuration of marram grass and the biodiversity by the statistical analyses of biodiversity patterns of invertebrates associated with marram grass tussocks and its spatial configuration along the coast of the Netherlands, Belgium, France.

We show that some, but not all biodiversity components aligns with putative flood protection services and provide an outlook for further research and applications.

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